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ABSTRACT

This study presents a dynamic systems model that suggests that social behavior emerges from the self-organization of cognition-emotion relationships and becomes stable through a process of positive feedback and coupling of components over time. Five 10- to 12-year-old children identified as anxious in evaluative situations by their teacher were paired with a non-anxious friend for purposes of the study. Latency to respond and heart rate were measured continuously as the anxious children were engaged in a computer task that required them to detect whether a pattern was repeated. The results showed evidence of synchronous and discontinuous changes, including changes in variability in the two variables. The first apparent shift for three of the five children was synchronous. Following the initial shift, it appeared that the interaction between cognitive and emotional variables became more complex, at times synchronous, at times loosely coupled, and at times uncoupled. (MDM)

THE STUDY OF COMPETENCE-ANXIETY RELATIONS WITHIN SOCIAL INTERACTION: A DYNAMIC SYSTEMS APPROACH.

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THE STUDY OF COMPETENCE-ANXIETY RELATIONS WITHIN SOCIAL INTERACTION USING A DYNAMIC SYSTEMS APPROACH

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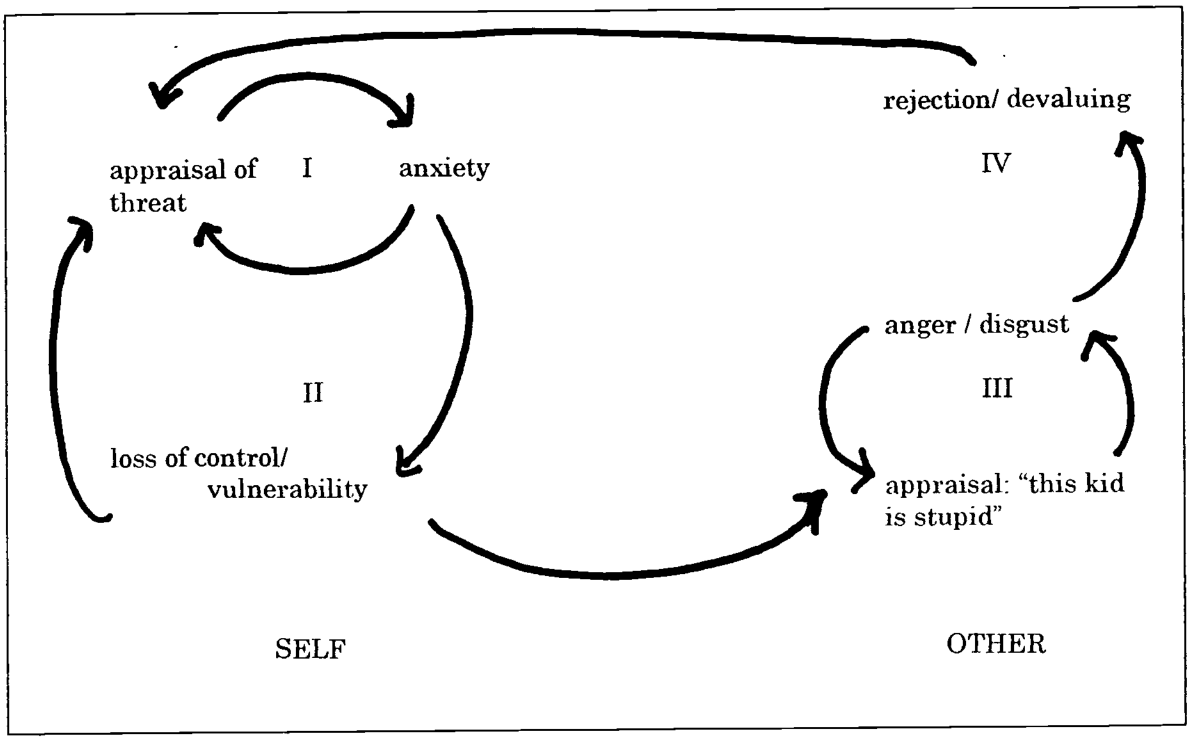
Cognitive deficits such as lack of perspective taking, poor interpersonal negotiation, difficulty reading social cues and making faulty attributions have been posited to account for the persistence and robustness of maladaptive social behaviour. This study argues that social behaviour can not be understood within a linear, cause and effect framework that attempts to attribute outcome to a primary cause such as a cognitive deficit. In contrast to such traditional approaches this study presents a dynamic systems model that suggests that social behaviour emerges from the self-organization of cognition-emotion relationships and becomes stable through a process of positive feedback and coupling of components over time.

The coherence of the model depends on the principles of self-organization, positive feedback, stability, attractors, collective variable, phase shifts and disequilibrium. However, the most prominent principle both in terms of explaining the emergence of new forms of behaviour and the stability of behaviour is the principle of positive feedback.

Positive feedback is responsible for the amplification of fluctuations and the emergence of new forms in behaviour. Emotions are particularly well suited to amplify fluctuations since they boost attention to small changes (Lewis, 1995). For example, a slight rise in anxiety may shift attention to a threatening aspect of a situation. A cognitive-affective structure can rapidly emerge as the appraisal of danger feeds upon itself in the presence of anxiety. It is suggested that for children with social difficulties, anxiety leads to four different feedback systems that work together to generate further anxiety and constrain thinking and behaviour in a stable, rigid pattern. The first two types of feedback operate within the individual and involve the dynamic interaction of emotion and cognition. The third and fourth type of feedback operate between the individual and others in his or her social environment (see Fig.1).

Fig. 1.



The four types of feedback can be seen to: (i) direct the flow of attention (to the threatening aspect of the situation for the anxious child and to the annoying aspects of the child's behaviour for the peer); (ii) set the occasion for coupling by decreasing the degrees of freedom in the system; (iii) generate stability, both in terms of the individuals' thoughts feelings and behaviour and the interpersonal interaction.

One aspect of the model was tested empirically. The aim was to show that at a critical threshold of social context, the relationship between emotion and cognition would change. Specifically, it was predicted that, if the two variables that were chosen to represent emotion and cognition (anxiety and latency to respond to an inference based cognitive task, respectively) were coupled, then change in both variables would be discontinuous and synchronous, moving from a stable relationship, to a variable relationship, to a different, but stable relationship.

Thelen and Ulrich (1991) suggest strategies for investigating how dynamic systems develop. In contrast to traditional statistical analyses, dynamic approaches take the individual and his or her behavioural changes over time as the fundamental units of study.

1)Defining the collective variable:

The first step was to define the collective variable, an observable and measurable parameter of the system of interest. Given the premise that emotion and cognition are coupled, the relationship between these two components were chosen to represent the collective variable. Heart rate was chosen as the best variable to represent the emotion of anxiety and latency to respond to an inference based task was chosen to represent attention, a component of cognition. When emotion and cognition are coupled, we should expect to see a covariance between them. At a critical level of the control parameter we should be able to see both variables change synchronously and discontinuously from a stable relationship to a variable relationship, to a different but stable relationship.

2)Defining the control parameter:

The control parameter triggers a phase shift and a reconfiguration of the components in a system. Social demands were hypothesized to be the control parameter for the emotion-cognition-behaviour system. A child's social behaviour can look quite different if the child is interacting within a safe family environment than if interacting with peers in the school yard where the demands for success are greater and the margin for error narrower.

3)Identifying the attractor states:

Tracking the relationship between anxiety and attention across time was expected to allow the identification of the shape of the attractors prior to, and subsequent to, the phase shift. This was done qualitatively for heart rate by using phase portraits that gave a visual picture of the trajectory and quantitatively by assessing the change in heart rate variance from different points in time. Any substantial change in variance was considered to be evidence for a potential phase shift.

Phase portraits were not suitable for depicting the pattern of latency to respond. Line graphs were used instead and changes in pattern were verified quantitatively by assessing changes to values greater or less that one standard deviation from the mean.

METHOD:

Five subjects were participants in this study. All subjects were enrolled in the same class in a small private school and were between the ages of 10 and 12 years. The five subjects, four male and one female, had been identified as anxious in evaluative situations by their teacher and had been paired with a non-anxious friend for the purpose of the study. Latency to respond and heart rate were measured continuously as the subject was engaged in a computer task that required him or her to detect whether a pattern repeated. The evaluative and competitive aspects of the task were heightened through a series of perturbations to assess whether the relationship between latency to respond and heart rate would undergo a phase shift.

RESULTS:

Results showed evidence of synchronous and discontinuous changes, including changes in variability in the two variables. Such changes are consistent with the hypothesis of phase shifts in cognition-emotion interactions. The first apparent shift for three of five subjects was synchronous. Following the initial shift, it appeared that the interaction between cognitive and emotional variables became more complex and the relationship between the two variables was at times synchronous, at times loosely coupled and at times uncoupled.

Table 3-6: Summary table indicating frequency of different phase shifts for all subjects.

Subject	Initial change synchronous "lag 0"	Additional synchronous changes "lag 0"	Initial change roughly synchronous "lag 1 / -1"	HR precedes latency "lag 1"	Latency precedes HR "lag -1"	Non-corresponding changes
A (04)	YES	0	no	1	0	0
B (03)	YES	1	no	2	0	0
C (05)	YES	0	no	2	0	1
D (06)	no	0	yes	0	2	2
E (02)	no	0	no	2	0	1

These results provide partial support for the prediction that a critical change in social demands can initiate a change in the relationship between emotion and cognition. The strength of the evidence depends in part on whether loosely coupled changes constitute synchronous change and so support the prediction of cognition & emotion being a collective variable.

The patterns for all subjects must be understood in terms of the complexities of both the physiological system and the psychological system. It may be unrealistic to expect to find strong, direct relationships between physiological and psychological variables given the complex, reciprocal interaction between the autonomic nervous system and psychological defense mechanisms, emotion and cognition. Each layer of defense, each response of the limbic system and hormonal mediated effects may influence the output of heart rate. It seems very difficult to accept, however, the thesis that physiological and psychological processes are unrelated. As in other studies (e.g. Blascovich et al. 1992; Gilligan & Bower, 1984; Izard, 1984; Kagan, 1988; Keable, 1989), the results of these five subjects certainly suggest a relationship between the physiological system and emotionality and between emotionality and cognition.

IMPLICATIONS OF THIS STUDY:

Empirical verification of emotion-cognition coupling is an important step in validating a dynamic systems model. Although "systems" metaphors have been used in psychology for many years to describe the complexity of developmental phenomena (e.g. Brofenbrenner, 1979; Gesell, 1946; Sameroff, 1983), corresponding empirical verification of the processes described have emerged only very recently. The dearth of empirical data is in part due to the limitations of current statistical methodologies which can not adequately measure nonlinear, complex processes if used conventionally. Traditional empirical work was constrained by this barrier and the understanding of complexity sacrificed in order to fit the empirical methodologies available at the time. Dynamic systems principles and modeling now enable us to study the complexity inherent in any developmental process and so bring together metaphorical understanding and empirical verification. Dynamic systems approaches enrich previous theoretical traditions, whether mechanistic, organismic or transactional, because, unlike the tenets of traditional theories, dynamic systems principles permit an understanding of the *process* or *"how"* of development.

This study also has clinical implications. When trying to understand social development and the maladaptive patterns of behaviour from a clinical perspective, it is crucial to have a framework that encompasses both multideterminancy and nonlinearity. Emotion-cognition coupling allows us a way to understand how behaviours emerge, become stable and crystallize across time. In this study, both stability and reorganization of emotional and cognitive components were seen in response to perturbation. This notion of emotion-cognition coupling can illustrate how behaviour or personality can be so flexible or plastic on one hand and yet so stable and coherent on the other, a difficult paradox to address through traditional linear avenues.

For clinicians, the principle of stability through coupling may also explain why the results of many intervention programs do not generalize or have only short term effects. Coupling can occur not only between emotion and cognitive appraisal, (type I feedback as described above). but also through the additional types of feedback described in the model developed in this paper. A clinical intervention such as a social skills group may effectively reorganize the cognition-cognition coupling that is nested within the cognition-emotion coupling in type I feedback, but the anticipation of loss of control or the established negative reputation with others may be strong enough to maintain the preferred relationship between emotion and cognition. Stability increases the more elements or subsystems are coupled. For a socially vulnerable child with a history of threatening interactions, attentional bias is pulled by its relationship with emotion towards things that confirm threat. A prevailing sense of inadequacy will override any momentary feeling of accomplishment or success. A similar process may be operating for clients in psychotherapy who, although aware of their patterns of behaviour, continue to recapitulate the same interpersonal dynamics with those they meet. Attempts to reorganize an individual's established pattern of behaviour must take into account the reciprocal interaction between emotion and cognition, the tendency for cognitive appraisals to consolidate and cohere in the presence of emotion and an awareness of other subsystems that are coupled and work to resist change.

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